

Amendments to the Claims

Please amend Claims 1-4, 7-11 and 24-40 to read as follows.

1. (Currently amended) A print position adjusting method for a printing apparatus, wherein the printing apparatus uses a print head having an array of a plurality of print elements and forms an image on a print medium by scanning ~~said the~~ print head in a direction different from an arranging direction of the plurality of print elements and wherein rasters making up the image are divided into at least two raster groups according to a driving mode of the plurality of print elements, an image corresponding to a plurality of rasters is printed by a plurality of print elements according to scanning of the print head and a single raster can be printed by a scan of the print head using one print element, said method for adjusting print positions by the plurality of print elements between the at least two raster groups, said method comprising the steps of:

forming a plurality of adjustment patterns by ~~said the~~ print head, in a manner that a print element drive timing between the at least two raster groups is shifted a predetermined interval, ~~said the~~ print element drive timing being a timing of driving the plurality of print elements;

entering an adjustment value for the print element drive timing between the at least two raster groups, the adjustment value being determined from the plurality of adjustment patterns; and

storing the entered adjustment value.

2. (Currently amended) A print position adjusting method as claimed in claim 1, wherein ~~said~~ the print head has at least two columns of print elements arranged side by side in the scan direction, the at least two columns of print elements are shifted from each other by an amount less than a pitch at which the print elements are arranged in ~~the~~ each column, and the at least two columns of print elements print the at least two raster groups.

3. (Currently amended) A print position adjusting method as claimed in claim 2, wherein ~~said~~ the print head has a nonvolatile memory in which unique information on ~~said~~ the print head is stored, the nonvolatile memory stores at least the adjustment value for adjusting the print positions, and said adjustment pattern forming step shifts the drive timing between the at least two columns of print elements by the predetermined interval by taking the adjustment value stored in the nonvolatile memory as a reference to form the plurality of adjustment patterns.

4. (Currently amended) A print position adjusting method as claimed in claim 1, wherein the printing apparatus scans ~~said~~ the print head with respect to ~~said~~ the print medium in a forward direction and in a backward direction and feeds the print medium relative to the print head in a direction perpendicular to the scan direction by a distance required to print an image on ~~said~~ the print medium at a density higher than that in which the plurality of print elements are arrayed, the relative feeding of the print medium

being performed between the forward scan and the backward scan, the forward scan and the backward scan being performed to print the two raster groups.

5. (Original) A print position adjusting method as claimed in claim 1, wherein the adjustment patterns have a dot distribution with a blue noise characteristic at a resolution at which the printing apparatus can print.

6. (Original) A print position adjusting method as claimed in claim 1, wherein the adjustment patterns are digitized by a conditional decision making method of a dithering method at a resolution at which the printing apparatus can print.

7. (Currently amended) A print position adjusting method as claimed in claim 1, wherein ~~said~~ the print head ejects ink to perform printing and each of the print elements ~~have~~ has a nozzle for ejecting the ink.

8. (Currently amended) A print position adjusting method as claimed in claim 7, wherein said printing apparatus can set a speed of the scan and a distance from the nozzles to the print medium in at least two stages, respectively, and has a step of correcting the adjustment value according to a combination of the scan speed and the distance.

9. (Currently amended) A print position adjusting method as claimed in claim 7, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink ~~as an energy~~ for ejecting ink from the nozzles.

10. (Currently amended) A print position adjusting method for a printing apparatus, wherein the printing apparatus uses a print head having an array of a plurality of nozzles for ejecting ink and forms an image on a print medium by scanning the print head in forward and backward directions different from an arranging direction of the plurality of nozzles and wherein a speed of the scan and a distance from the nozzles to the print medium can be set in at least two stages, respectively, said method for adjusting positions of ink dots ejected from the plurality of nozzles between the scans in the forward and backward directions, said method comprising the steps of:

forming a plurality of adjustment patterns by the print head, in a manner that an ink ejection timing between the forward and backward scans is shifted by a predetermined interval, the ink ejection timing being a timing of ejecting ink from the plurality of nozzles;

entering an adjustment value for the ink ejection timing between the forward and backward scans, the adjustment value being determined from the plurality of adjustment patterns;

storing the entered adjustment value; and

correcting the adjustment value according to a combination of the scan speed and the distance in performing a print operation.

11. (Currently amended) A print position adjusting method as claimed in claim 10, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink ~~as an energy~~ for ejecting ink from the nozzles.

12. (Withdrawn) A printing apparatus using a print head having an array of a plurality of print elements and forming an image on a print medium by scanning said print head in a direction different from an arranging direction of the plurality of print elements, wherein rasters making up the image are divided into at least two raster groups according to a driving mode of the plurality of print elements, said apparatus comprising:

means for forming a plurality of adjustment patterns by said print head, in a manner that a print element drive timing between the at least two raster groups is shifted a predetermined interval, said print element drive timing being a timing of driving the plurality of print elements; and

means for storing an adjustment value for the print element drive timing between the at least two raster groups, the adjustment value being supplied based on judgement of the plurality of adjustment patterns.

13. (Withdrawn) A printing apparatus as claimed in claim 12, wherein said print head has at least two columns of print elements arranged side by side in the scan direction, the at least two columns of print elements are shifted from each other by an amount less than a pitch at which the print elements are arranged in the column, and the at least two columns of print elements print the at least two raster groups.

14. (Withdrawn) A printing apparatus as claimed in claim 13, wherein said print head has a nonvolatile memory in which unique information on said print head is stored, the nonvolatile memory stores at least the adjustment value for adjusting the print positions, and said adjustment pattern forming means shifts the drive timing between the at least two columns of print elements by the predetermined interval by taking the adjustment value stored in the nonvolatile memory as a reference to form the plurality of adjustment patterns.

15. (Withdrawn) A printing apparatus as claimed in claim 12, further comprising means for scanning said print head with respect to said print medium in a forward direction and in a backward direction and for feeding the print medium relative to the print head in a direction perpendicular to the scan direction by a distance required to print an image on said print medium at a density higher than that in which the plurality of print elements are arrayed, the relative feeding of the print medium being performed between the forward scan and the backward scan, the forward scan and the backward scan being performed to print the two raster groups.

16. (Withdrawn) A printing apparatus as claimed in claim 12, wherein the adjustment patterns have a dot distribution with a blue noise characteristic at a resolution at which the printing apparatus can print.

17. (Withdrawn) A printing apparatus as claimed in claim 12, wherein the adjustment patterns are digitized by a conditional decision making method of a dithering method at a resolution at which the printing apparatus can print.

18. (Withdrawn) A printing apparatus as claimed in claim 12, wherein said print head ejects ink to perform printing and the print elements have a nozzle for ejecting the ink.

19. (Withdrawn) A printing apparatus as claimed in claim 18, further comprising means for setting a speed of the scan and a distance from the nozzles to the print medium in at least two stages respectively and means for correcting the adjustment value according to a combination of the scan speed and the distance.

20. (Withdrawn) A printing apparatus as claimed in claim 18, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink as an energy for ejecting ink from the nozzles.

21. (Withdrawn) A printing apparatus using a print head having an array of a plurality of nozzles for ejecting ink and forming an image on a print medium by scanning the print head in forward and backward directions different from an arranging direction of the plurality of nozzles, wherein a speed of the scan and a distance from the

nozzles to the print medium can be set in at least two stages respectively, said apparatus comprising:

means for forming a plurality of adjustment patterns by the print head, in a manner that an ink ejection timing between the forward and backward scans is shifted by a predetermined interval, the ink ejection timing being a timing of ejecting ink from the plurality of nozzles;

means for storing an adjustment value for the ink ejection timing between the forward and backward scans, the adjustment value being supplied based on judgement of the plurality of adjustment patterns; and

means for correcting the adjustment value according to a combination of the scan speed and the distance in performing a print operation.

22. (Withdrawn) A printing apparatus as claimed in claim 21, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink as an energy for ejecting ink from the nozzles.

23. (Withdrawn) A printing system comprising:

a printing apparatus using a print head having an array of a plurality of print elements and forming an image on a print medium by scanning said print head in a direction different from an arranging direction of the plurality of print elements, wherein rasters making up the image are divided into at least two raster groups according to a driving mode of the plurality of print elements, said apparatus having:

means for forming a plurality of adjustment patterns by said print head, in a manner that a print element drive timing between the at least two raster groups is shifted a predetermined interval, said print element drive timing being a timing of driving the plurality of print elements; and

means for storing an adjustment value for the print element drive timing between the at least two raster groups, the adjustment value being supplied based on judgement of the plurality of adjustment patterns; and

a host apparatus for supplying image data to said printing apparatus, having:

means for controlling said printing apparatus to form the plurality of adjustment patterns;

means for accepting entering of the adjustment value based on judgement of the plurality of adjustment patterns; and

means for supplying the adjustment data to said printing apparatus.

24. (Withdrawn) A printing system comprising:

a printing apparatus using a print head having an array of a plurality of nozzles for ejecting ink and forming an image on a print medium by scanning the print head in forward and backward directions different from an arranging direction of the plurality of nozzles, wherein a speed of the scan and a distance from the nozzles to the print medium can be set in at least two stages, respectively, said apparatus having:

means for forming a plurality of adjustment patterns by the print head, in a manner that an ink ejection timing between the forward and backward scans is shifted by a

predetermined interval, the ink ejection timing being a timing of ejecting ink from the plurality of ~~nozzles~~; nozzles.

means for storing an adjustment value for the ink ejection timing between the forward and backward scans, the adjustment value being supplied based on judgement of the plurality of adjustment ~~patterns~~; patterns, and

means for correcting the adjustment value according to a combination of the scan speed and the distance in performing a print operation; and

a host apparatus for supplying image data to said printing apparatus, said host apparatus having:

means for controlling said printing apparatus to form the plurality of adjustment ~~patterns~~; patterns.

means for accepting entering of the adjustment value based on judgement of the plurality of adjustment ~~patterns~~; patterns, and

means for supplying the adjustment ~~data~~ value to said printing apparatus.

25. (Currently amended) A storage medium storing a program for performing a print position adjusting method for a printing apparatus, wherein the printing apparatus uses a print head having an array of a plurality of print elements and forms an image on a print medium by scanning ~~said~~ the print head in a direction different from an arranging direction of the plurality of print elements and wherein rasters making up the image are divided into at least two raster groups according to a driving mode of the plurality of print elements, an image corresponding to a plurality of rasters is printed by a

plurality of print elements according to scanning of the print head and a single raster can be printed by a scan of the print head using one print element, said method for adjusting print positions by the plurality of print elements between the at least two raster groups, said method comprising the steps of:

forming a plurality of adjustment patterns by ~~said~~ the print head, in a manner that a print element drive timing between the at least two raster groups is shifted a predetermined interval, ~~said~~ the print element drive timing being a timing of driving the plurality of print elements;

entering an adjustment value for the print element drive timing between the at least two raster groups, the adjustment value being determined from the plurality of adjustment patterns; and

storing the entered adjustment value.

26. (Currently amended) A storage medium storing a program for performing a print position adjusting method for a printing apparatus, wherein the printing apparatus uses a print head having an array of a plurality of nozzles for ejecting ink and forms an image on a print medium by scanning the print head in forward and backward directions different from an arranging direction of the plurality of nozzles and wherein a speed of the scan and a distance from the nozzles to the print medium can be set in at least two stages, respectively, said method for adjusting positions of ink dots ejected from the plurality of nozzles between the scans in the forward and backward directions, said method comprising the steps of:

forming a plurality of adjustment patterns by the print head, in a manner that an ink ejection timing between the forward and backward scans is shifted by a predetermined interval, the ink ejection timing being a timing of ejecting ink from the plurality of nozzles;

entering an adjustment value for the ink ejection timing between the forward and backward scans, the adjustment value being determined from the plurality of adjustment patterns;

storing the entered adjustment value; and

correcting the adjustment value according to a combination of the scan speed and the distance in performing a print operation.

27. (Currently amended) A print position adjusting method for adjusting a print position on a print medium during a forward scan and a print position on the print medium during a backward scan in a printing apparatus, wherein ~~said~~ the printing apparatus removably supports a print head on which a plurality of ink ejection openings are arranged, and reciprocally scans ~~said~~ the print head in a direction different from the arranging direction while ejecting ink to form an image, said method comprising the steps of:

referring to first memory means in ~~said~~ the printing apparatus storing first print position information associated with characteristic variations of ~~said~~ the printing apparatus and second memory means in ~~said~~ the print head storing second print position

information associated with characteristic variations of ~~said~~ the print head, before forming an image by mounting ~~said~~ the print head on ~~said~~ the printing apparatus; and

determining an adjustment value for adjusting the print position, based on ~~said~~ the first and second print position information obtained by in said referring step.

28. (Currently amended) A print position adjusting method as claimed in claim 27, wherein said first print position information includes information on a distance from a member for restricting a printing surface of the print medium to the ~~nozzles~~ openings.

29. (Currently amended) A print position adjusting method as claimed in claim 27, wherein ~~said~~ the second print position information includes information on an ejection speed of ink ejected from ~~said~~ the print head.

30. (Currently amended) A print position adjusting method as claimed in claim 27, wherein each of ~~said~~ the first and second memory means has a form of nonvolatile memory.

31. (Currently amended) A print position adjusting method as claimed in claim 27, wherein ~~said~~ the print head has at least two columns of ejection openings arranged side by side in the scan direction, ~~said~~ the at least two columns of ejection

openings are shifted from each other by an amount less than a pitch at which the ejection openings are arranged in ~~the~~ each column.

32. (Currently amended) A print position adjusting method as claimed in claim 27, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink ~~as an energy~~ for ejecting ink from the ejection openings.

33. (Currently amended) A print position adjusting method for adjusting a print position on a print medium during a forward scan and a print position on the print medium during a backward scan in a printing apparatus, wherein ~~said~~ the printing apparatus removably supports a print head on which a plurality of ink ejection openings are arranged, and reciprocally scans ~~said~~ the print head in a direction different from the arranging direction while ejecting ink to form an image, said method comprising the steps of:

detecting a temperature of ~~said~~ the print head;

estimating an ejection speed of ink ejected from ~~said~~ the print head based on the detected temperature; and

determining an adjustment value for adjusting ~~said~~ the print positions based on the estimated ejection speed.

34. (Currently amended) A print position adjusting method as claimed in claim 33, wherein ~~said~~ the ejection speed is estimated from information on the detected

temperature and from information on ~~the~~ an ejection speed characteristic of ~~said~~ the print head and stored in memory means of ~~said~~ the print head.

35. (Currently amended) A print position adjusting method as claimed in claim 33, wherein ~~said~~ the print head has at least two columns of ejection openings arranged side by side in the scan direction, ~~said~~ the at least two columns of ejection openings are shifted from each other by an amount less than a pitch at which the ejection openings are arranged in ~~the~~ each column.

36. (Currently amended) A print position adjusting method as claimed in claim 33, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink ~~as an energy~~ for ejecting ink from the ejection openings.

37. (Currently amended) A print position adjusting method for adjusting a print position on a print medium during a forward scan and a print position on the print medium during a backward scan in a printing apparatus, wherein ~~said~~ the printing apparatus removably supports a print head on which a plurality of ink ejection openings are arranged, and reciprocally scans ~~said~~ the print head in a direction different from ~~the~~ an arranging direction of the ejection openings while ejecting ink to form an image, said method comprising the steps of:

detecting a temperature of ~~said~~ the print head;

switching a drive frequency and a scan speed of ~~said~~ the print head based on the detected temperature;

estimating an ejection speed of ink ejected from ~~said~~ the print head based on the detected temperature; and

determining an adjustment value for adjusting ~~said~~ the print positions based on the estimated ejection speed and the scan speed.

38. (Currently amended) A print position adjusting method as claimed in claim 37, wherein ~~said~~ the ejection speed is estimated from information on the detected temperature and from information on ~~the~~ an ejection speed characteristic of ~~said~~ the print head and stored in memory means of ~~said~~ the print head.

39. (Currently amended) A print position adjusting method as claimed in claim 37, wherein ~~said~~ the print head has at least two columns of ejection openings arranged side by side in the scan direction, ~~said~~ the at least two columns of ejection openings are shifted from each other by an amount less than a pitch at which the ejection openings are arranged in ~~the~~ each column.

40. (Currently amended) A print position adjusting method as claimed in claim 37, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink ~~as an energy~~ for ejecting ink from the ejection openings.

41. (Withdrawn) A printing apparatus removably supporting a print head on which a plurality of ink ejection openings are arranged, and reciprocally scanning said print head in a direction different from the arranging direction while ejecting ink to form an image, said apparatus comprising:

first memory means for storing first print position information associated with characteristic variations of said printing apparatus;

means for referring said first memory means and second memory means in said print head storing second print position information associated with characteristic variations of said print head, before forming an image by mounting said print head on said printing apparatus; and

means for determining an adjustment value for adjusting a print position on a print medium during a forward scan and a print position on the print medium during a backward scan, based on said first and second print position information obtained by said referring.

42. (Withdrawn) A printing apparatus as claimed in claim 41, wherein said first print position information includes information on a distance from a member for restricting a printing surface of the print medium to the nozzles.

43. (Withdrawn) A printing apparatus as claimed in claim 41, wherein said second print position information includes information on an ejection speed of ink ejected from said print head.

44. (Withdrawn) A printing apparatus as claimed in claim 41, wherein each of said first and second memory means has a form of nonvolatile memory.

45. (Withdrawn) A printing apparatus as claimed in claim 41, wherein said print head has at least two columns of ejection openings arranged side by side in the scan direction, said at least two columns of ejection openings are shifted from each other by an amount less than a pitch at which the ejection openings are arranged in the column.

46. (Withdrawn) A printing apparatus as claimed in claim 41, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink as an energy for ejecting ink from ejection openings.

47. (Withdrawn) A printing apparatus removably supporting a print head on which a plurality of ink ejection openings are arranged, and reciprocally scanning said print head in a direction different from the arranging direction while ejecting ink to form an image, said apparatus comprising:

means for detecting a temperature of said print head;

means for estimating an ejection speed of ink ejected from said print head based on the detected temperature; and

means for determining an adjustment value for adjusting a print position on a print medium during a forward scan and a print position on the print medium during a backward scan based on the estimated ejection speed.

48. (Withdrawn) A printing apparatus as claimed in claim 47, wherein said ejection speed is estimated from information on the detected temperature and from information on the ejection speed characteristic of said print head and stored in memory means of said print head.

49. (Withdrawn) A printing apparatus as claimed in claim 47, wherein said print head has at least two columns of ejection openings arranged side by side in the scan direction, said at least two columns of ejection openings are shifted from each other by an amount less than a pitch at which the ejection openings are arranged in the column.

50. (Withdrawn) A printing apparatus as claimed in claim 47, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink as an energy for ejecting ink from ejection openings.

51. (Withdrawn) A printing apparatus removably supporting a print head on which a plurality of ink ejection openings are arranged, and reciprocally scanning said print head in a direction different from the arranging direction while ejecting ink to form an image, said apparatus comprising:

means for detecting a temperature of said print head;

means for switching a drive frequency and a scan speed of said print head based on the detected temperature;

means for estimating an ejection speed of ink ejected from said print head based on the detected temperature; and

determining an adjustment value for adjusting a print position on a print medium during a forward scan and a print position on the print medium during a backward scan based on the estimated ejection speed and the scan speed.

52. (Withdrawn) A printing apparatus as claimed in claim 51, wherein said ejection speed is estimated from information on the detected temperature and from information on the ejection speed characteristic of said print head and stored in memory means of said print head.

53. (Withdrawn) A printing apparatus as claimed in claim 51, wherein said print head has at least two columns of ejection openings arranged side by side in the scan direction, said at least two columns of ejection openings are shifted from each other by an amount less than a pitch at which the ejection openings are arranged in the column.

54. (Withdrawn) A printing apparatus as claimed in claim 51, wherein the print head has heating elements to generate thermal energy for causing film boiling in ink as an energy for ejecting ink from ejection openings.